**NAME OF COURSE/CLASS:** 6th Grade Science

**LESSON TITLE:** Elements and the Periodic Table

**ANTICIPATED INSTRUCTIONAL TIME:** One to two 50 minute class periods

**ENDURING UNDERSTANDING:** In order to gain a better understanding of our natural world, we must first be able to recognize that all matter is made up of smaller units called atoms. It is the structure of the atom itself that gives an element its unique chemical and physical properties. It is through the observation of both chemical and physical properties of substances that we are able to know what a substance is and how it will behave in relation to other substances. We categorize materials based on the chemical and physical properties it exhibits as well as by the structure of its atoms. We can further investigate how these atoms combine to form more complex materials.

**RATIONALE:** Students must first understand the basic structure of matter (the atom) and how matter is characterized and organized by its properties and structure (subatomic) in order to understand more complex materials (compounds and mixtures) and their interactions with the natural world. Learning the elements and how their structure relates to their physical properties as well as their chemical reactivity is necessary for further investigation into the chemical processes that matter goes through as well as the possible uses of such reactions.

**GOALS OF THE LESSON:**

* G.4.1 To understand the basic unit of matter and its structure
* G.4.2 To characterize elements according to their physical and chemical properties
* G.4.3 To recognize the patterns of organization of elements in the periodic table
* G.4.4 To investigate the properties and uses of elements in the natural world

**OBJECTIVES OF THE LESSON:**

* O.4.1 Students will demonstrate their knowledge of atoms and subatomic structure
* O.4.2 Students will use the periodic table to identify elements based on subatomic structure
* O.4.3 Students will recognize elements by their physical and chemical characteristics and structure
* O.4.4 Students will categorize elements according to where they are located on the periodic table
* O.4.5 Students will display newly acquired information of an element upon the conclusion of an investigation
* O.4.6 Students will communicate their ideas and questions about the periodic table
* O.4.7 Students will relate elements to compounds found in the natural world
* O.4.8 Students will evaluate whether or not their investigation answered their questions

**MULTIPLE REPRESENTATIONS (TOOLS):** Material will be presented using a variety of methods. Included in this lesson will be: lecture/note taking, online video, small group discussion, visual aid (periodic table handout), and a variety of additional paper and online resources used during the investigative portion of the activity. The idea is to present the material from a variety of viewpoints as well as to allow students to investigate their questions using a variety of methods.

**SD CONTENT STANDARDS ADDRESSED:**

* Science
* 6.P.1.1. Students are able to identify the subatomic particles that make up atoms.
* 6.P.1.2. Students are able to classify matter based on physical and chemical properties.
* Nature of Science
* 6.N.2.1. Students are able to pose questions that can be explored through scientific investigations.

**NATIONAL CONTENT STANDARDS ADDRESSED:**

* Unifying concepts and processes in science.
  + K-12
    - Systems, order, and organization.
    - Evidence, models, and explanation.
* Science as inquiry.
* 5-8
* Abilities necessary to do scientific inquiry
* Understandings about scientific inquiry
* Physical science
* 5-8
  + Properties and changes of properties in matter
* History and nature of science
* 5-8
* Science as a human endeavor
* Nature of science
* History of science

**INSTRUCTOR MATERIALS:**

Periodic Table handouts (1 per student)

11x17 paper (1 per student)

Scissors, glue, markers, crayons etc. for making posters

Element names on strips of paper for drawing

Instruction sheets for poster project (1 per student)

White/dry-erase board for note taking

Computer & Printer

**LESSON OUTLINE:**

**5 min: Finish up previous lesson-History of Atom Model**

Notes: James Chadwick: discovered neutrons (uncharged particles in the nucleus)

Niels Bohr: discovered evidence that electrons in atoms are arranged according to energy levels; led to the modern atomic model; electron clouds rather than orbits

1930’s: matter is made up of atoms; continued research on subatomic particles, these can be broken down into smaller particles called quarks

**5 min: Lead in to new material**

Question: So why do you think it would be important to know the atomic structure of a material? How many protons, neutrons, electrons etc.?

The atomic structure of matter helps us determine how it looks, behaves in relation to other materials. We can organize or sort materials based on these properties. Many of these are the same properties we learned about in chapter 3. By looking at physical and chemical properties, we can tell what an unknown substance is. If we have this data, we can organize it in a table.

**10 min: Exploring the Periodic Table**

With a partner, students are each given a handout of the periodic table and are asked to develop 2-3 questions they have or want to know about the periodic table. Students are asked to write down their questions and keep them. After the lesson and assessment project, they will analyze whether or not their questions have been answered to their satisfaction.

**5 min: Video**

“Meet the Elements”

<http://www.nclark.net/Meet_the_Elements.html>

**20 min: New material**

Notes: Matter made up of only one kind of atom is called an element. Elements combine to form air (Nitrogen & Oxygen), minerals in rocks (Calcium & Sodium), and liquids (Hydrogen and Oxygen as in water) for example. Gold, Silver, Aluminum, and Iron are all elements. Some elements are naturally occurring and some are synthetic or man-made.

We sort and organize the elements according to their properties in a chart called the Periodic Table. The table is made up of rows called Periods and columns called Groups. All elements in a Period have the same number of energy levels and all elements in a group have similar properties related to their structure and tend to form similar bonds.

Identifying Characteristics: Each element is different and has unique properties described by looking at relationships between the atomic particles in each element.

Ex. Atomic Number=#of protons; each element increases by one

Isotopes: every atom of the same element has the same number of protons (atomic number) but atoms of the same element can have different numbers of neutrons.

Ex. Cl-35 and Cl-37

Some physical properties included with each element in the periodic table include:

Mass Number: the number of protons plus the number of neutrons

Ex. Cl has 17 protons always, but it can have a different number of neutrons. Its isotopes Cl-35 and Cl-37 have different numbers of neutrons.

We can tell the number of neutrons by subtracting:

Atomic Number from the Mass Number: 35-17=18 neutrons in Cl-35 and 37-17=20 neutrons in Cl-37.

An increase in the number of neutrons equals an increase in the total mass of the atom

Atomic Mass: average mass of all isotopes

Ex. Chlorine Cl-35 makes up 76% of all Chlorine atoms found while Cl-37 makes up the other 24%. The average mass of all isotopes is 35.45

Classification of Elements: 3 Categories

1. Metals: shiny, metallic luster, good conductors of heat and electricity, malleable, ductile, solids at room temperature (except Mercury Hg liquid)
2. Nonmetals: dull, poor conductors of heat and electricity, many are gases at room temperature (except Bromine Br liquid). Solid nonmetals are brittle (break easily). The nonmetals are essential to the chemicals of life and make up more than 97% of your body. Ex. Carbon, Nitrogen, Calcium, Oxygen, Hydrogen (p.111 graphic). They are found on the right side of the periodic table (except Hydrogen)
3. Metalloids: have characteristics/properties of both metals and nonmetals and are solids at room temperature. They are found between metals and nonmetals on the periodic table. Some are shiny and many are conductors, but not as good as metals.

**5 min: Assignment**

Students will pick from a hat or bowl an element to investigate. Each student will be given an 11x17 sheet of paper to make a poster advertising his or her element. Each student will receive an instruction sheet as well as a list of resources that may be useful. Students will have 3 days to complete their poster and should work on the poster outside of class.

In addition, students will complete the section review questions (p. 111 Self Check 1-5) (due the following day) and will be given additional exercises (p. 123 Thinking Critically # 14, 15, 17, and 18) to complete for additional practice using the periodic table. The additional exercises are optional.

**EMBEDDED/FORMATIVE ASSESSMENT OPPORTUNITIES:** During the course of student discussions regarding the periodic table, I will be listening to assess whether or not some of the important questions become apparent to students. I will listen to see that they are developing meaningful questions that can be investigated through scientific reasoning and research. I will also be using questioning during note taking to be certain students understand the information presented.

**ASSESSMENT/HOMEWORK:** Diagnostic and Summative Assessment will take place through the use of the poster project as well as the section review questions. Any perceived problem areas (indicated by the section review answers) will be clarified at the start of the next class period before moving on to the next lesson. Students will also be encouraged to present any information they found or questions they were able to answer over the course of their investigation.

**ACCOMMODATIONS:** Students will be encouraged to come in for extra help regarding complex ideas. I will also provide classroom materials to use in the creation of their posters for those students who need them. I will allow the use of extra class time to work on the posters and will have computers available for those who do not have access outside of school. This will also include time before and after school. Any other accommodations will be met on an individual basis depending on the circumstances.

**RESOURCES:**

1. Biggs, A., Daniel, L., Feather, R.M., Ortleb, E., Leach Snyder, S., & Zike, D. (2008). *Science: Level Red*. Columbus, OH: Mc Graw-Hill
2. <http://www.nap.edu/openbook.php?record_id=4962&page=104>
3. <http://www.sciencespot.net/Pages/kdzchem2.html>
4. <http://www.webelements.com/nexus/node/982>
5. <http://www.sciencegeek.net/tables/EniGcolor.pdf>

I’d Like to Buy an Element Please

Objective:

Each student will create a poster “advertising” his or her element. The goal is to provide as much useful information about the element as possible to the “buyer”. You want to be able to “sell” your element.

In the process of producing your poster, you will be researching and finding information regarding your element as well as finding useful information regarding the classification and organization of elements in the Periodic Table.

Instructions:

Posters will be done on the 11x17 paper provided. Students may use any other materials they wish (crayons, cloth material, glue, construction paper, etc.) in designing their poster. Just remember, the posters will be hung up for presentation, so try not to make them too heavy.

Information You May Include:

Element Name and Symbol

Important Numbers (e.g. mass number, atomic number, boiling pt.)

Physical Properties

Chemical Properties

Unusual Facts

Discovery Information

Dangers

Uses

Price

Due Date:

Posters will be due on Friday October 16 during your assigned class period. This isn’t much time so get started right away. You will need to work on your poster in your spare time at school and at home. This is a good project to ask for a parent’s help.

Helpful Resources:

Some helpful websites can be found at:

<http://www.sciencespot.net/Pages/kdzchem2.html>

You may also try searching using your element name, but remember you want the best information out there, so choose your sources wisely. Library books and encyclopedias can also be useful tools.

Hydrogen H 1

Helium He 2

Lithium Li 3

Beryllium Be 4

Boron B 5

Carbon C 6

Nitrogen N 7

Oxygen O 8

Fluorine F 9

Neon Ne 10

Sodium Na 11

Magnesium Mg 12

Aluminum Al 13

Silicon Si 14

Phosphorus P 15

Sulfur S 16

Chlorine Cl 17

Argon Ar 18

Potassium K 19

Calcium Ca 20

Scandium Sc 21

Titanium Ti 22

Vanadium V 23

Chromium Cr 24

Manganese Mn 25

Iron Fe 26

Cobalt Co 27

Nickel Ni 28

Copper Cu 29

Zinc Zn 30

Gallium Ga 31

Germanium Ge 32

Arsenic As 33

Selenium Se 34

Bromine Br 35

Krypton Kr 36

Rubidium Rb 37

Strontium Sr 38

Yttrium Y 39

Zirconium Zr 40

Niobium Nb 41

Molybdenum Mo 42

Technetium Tc 43

Ruthenium Ru 44

Rhodium Rh 45

Palladium Pd 46

Silver Ag 47

Cadmium Cd 48

Indium In 49

Tin Sn 50

Antimony Sb 51

Tellurium Te 52

Iodine I 53

Xenon Xe 54

Cesium Cs 55

Barium Ba 56

Lanthanum La 57

Cerium Ce 58

Praseodymium Pr 59

Neodymium Nd 60

Promethium Pm 61

Samarium Sm 62

Europium Eu 63

Gadolinium Gd 64

Terbium Tb 65

Dysprosium Dy 66

Holmium Ho 67

Erbium Er 68

Thulium Tm 69

Ytterbium Yb 70

Lutetium Lu 71

Hafnium Hf 72

Tantalum Ta 73

Tungsten W 74

Rhenium Re 75

Osmium Os 76

Iridium Ir 77

Platinum Pt 78

Gold Au 79

Mercury Hg 80

Thallium Tl 81

Lead Pb 82

Bismuth Bi 83

Polonium Po 84

Astatine At 85

Radon Rn 86

Francium Fr 87

Radium Ra 88

Actinium Ac 89

Thorium Th 90

Protactinium Pa 91

Uranium U 92

Neptunium Np 93

Plutonium Pu 94

Americium Am 95

Curium Cm 96

Berkelium Bk 97

Californium Cf 98

Einsteinium Es 99

Fermium Fm 100

Mendelevium Md 101

Nobelium No 102

Lawrencium Lr 103

Rutherfordium Rf 104

Dubnium Db 105

Seaborgium Sg 106

Bohrium Bh 107

Hassium Hs 108

Meitnerium Mt 109

Darmstadtium Ds 110

Roentgenium Rg 111

Copernicium Cp 112

Ununtrium Uut 113

Ununquadium Uuq 114

Ununpentium Uup 115

Ununhexium Uuh 116

Ununseptium Uus 117

Ununoctium Uuo 118